

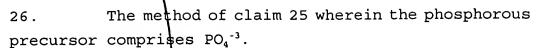


WHAT IS CLAIMED IS:

- 1. A collection of particles comprising a crystalline composition with a phosphate anion, the collection of particles having an average particle size less than about 1000 nm.
- P. The collection of particles of claim 1 having an average particle size from 5 nm to about 250 nm.
- The dollection of particles of claim 1 having an/average particle size from 5 nm to about 100 nm.
- The collection of particles of claim 1 having a plurality of metals in the composition.
- 5. The collection of particles of claim 4 wherein one of the plurality of metals is lithium.
- 6. The collection of particle of claim 1 having pleast three metals within the composition.
- 7. The collection of particles of claim 1 wherein the composition comprises Li_xFePQ_4 , $0.1 \le x \le 1$.
- 8. The collection of part/icles of claim 1 wherein the composition comprises $LiFe_{1-x}Mn_xPO_4$, $0 \le x \le 0.8$.
- The collection of particles of claim 1 wherein the composition comprises $LiFe_{1-x}Mn_xPO_4$, $0.4 \le x \le 0.8$.
- The collection of particles of claim 1 wherein the composition comprises $M_x PO_4$, wherein M is a metal, x is a rational number and $x \le 4$.
- 11. The collection of particles of claim 1 wherein the composition comprises $Fe_3(PO_4)_2$.
- 12. The collection of particles of claim 1 wherein the composition comprises FePO₄.
- 13. The collection of particles of claim 1 having essentially no particle with an diameter greater than about 5 times the average particle size.
- 14. The collection of particles of claim 1 having essentially no particle with an diameter greater than about 3 times the average particle size.

The collection of particles of claim 1 having 15. a distribution of particle sizes such that at least about 9\$ percent of the particles have a diameter greater than about 40 percent of the average diameter and less than about 160 percent of the average diameter.

- A battery comprising an cathode, the cathode 16. comprising the collection of particles of claim 1, the particles comprising lithium metal phosphate.
- The battery of claim 16 wherein the lithium 17. metal phosphate comprises LigFePO4.
- The\battery of claim \16 wherein the lithium 18. metal phosphate comprises LiFe_{1-x}Mn_xPO₄, where $0.6 \le x \le 0.8$.
- 19. The battery of claim 16 comprising an anode having lithium metal.
- The battery of claim 16 comprising an anode 20. 'having a lithium intercalation compound.
- collection of particles comprising 21. collection of amdrphous particles, the particles comprising a phosphate composition having an average particle size less than about 95 nm.
- A method for producing particles comprising a 22. composition with a \backslash polyatomic anion, the method comprising reacting a reactant stream in a gas flow, the reactant stream comprising an aerosol, the aerosol comprising a polyatomid anion precursor, the polyatomic anion precursor comprising a phosphorous precursor, a sulfur precursor or a silicon precursor.
- 23. The method of/claim/22 wherein the reaction is driven by energy from /a laght beam.
- The method of claim 23 wherein the light beam 24. is an infrared laser/beam.
- The method of claim 22 wherein the polyatomic 25. anion precursor comprises a phosphorous precursor.



- 27. The method of claim 25 wherein the phosphorous precursor comprises POCl₃.
- 28. The method of claim 22 wherein the polyatomic anion precursor comprises a sulfur precursor.
- 29. The method of claim 27 wherein the sulfur precursor comprises SO_4^{-2} .
- 30. The method of claim 28 wherein the sulfur precursor is selected from the group consisting of SOCl₂ and SO₂Cl₂.
- The method of claim 22 wherein the polyatomic anion precursor comprises a silicon precursor.
- 32. The method of claim 31 wherein the silicon precursor comprises SiQ_4^{-4} .
- 33. The method of claim 31 wherein the silicon precursor comprises SiCl₄.
- 34. The method/of/claim/31 wherein the silicon precursor comprises/tetramethylammonium silicate.
- 35. The method of claim 22 wherein the aerosol comprises an aqueous solution.
- 36. The method of claim 22 wherein the reactant stream further comprises a lithium precursor.
- 37. The method of claim 22 wherein the reactant stream further comprises a plurality of metals.
- 38. The method of claim 22 wherein the reactant stream further comprises lithium precursors and iron precursors.
- A method for producing particles comprising a composition with a polyatomic anion, the method comprising reacting a reactant stream in a gas flow, the reactant stream comprising a polyatomic anion precursor, the polyatomic anion precursor comprising a phosphorous



precursor, a sulfur precursor or a silicon precursor and the reaction being driven by an intense light beam.

A method for producing lithium iron phosphate, the method comprising reacting a lithium precursor, an iron precursor and a phosphorous precursor in the presence of O_2 to produce crystalline lithium iron phosphate.

41. method \ for producing a collection of particles comprising \a mixed metal phosphate compound, the collection of particles having an average particle size of no more than \1000 nm, the method comprising heating submicron meta / oxide particles combined with ammonium phosphate.

The method of claim 41 wherein the ammonium 42. phosphate comprises NH4H2HO4.

The method/of/cl $\frac{1}{4}$ im 41 wherein the metal oxide 43. comprises a mixture of two different metal oxides.

The method of claim 11 wherein the metal oxide 44. comprises Li,CO,.

The method of claim 41 wherein the metal oxide 45. and ammonium phosphate is also combined with Li₂CO₃.

A method of coating \a substrate, the method **4**6. comprising:

reacting a reactant \stream by directing a focused radiation beam at the reactant stream to produce a product stream comprising particles downstream from the radiation beam, wherein the reaction is driven by energy \ from the radiation beam, the reactant stream comprising a precursor, polyatomic anion \ polyatomic anion precursor comprising a phosphorous precursor, a precursor or a silicoh precursor;

directing the product stream to a substrate to coat the substrate.

47. The method of claim 46 further comprising moving the substrate relative to the product stream.

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